CLAIMS

1. A high power semiconductor laser for generating a laser beam of a given wavelength, said laser comprising
- an active region comprising a gain region and a waveguide,
- one or more cladding layers,

characterized by
- a large optical superlattice structure (LOSL) in one of said cladding layers, said superlattice structure being or comprising at least two superlattice layers differing in their respective refractive indices, each said layer having a thickness larger than the de Broglie wavelength of the electrons in said active region.

2. The laser according to claim 1, *wherein*
- each said superlattice layer has a thickness of at least 20 nm, preferably between 20 nm and 500nm.

3. The laser according to claim 1, *wherein*
- the superlattice structure comprises at least two alternatingly stacked superlattice layers which in their totality result in a predetermined overall refractive index of said superlattice structure.

4. The laser according to claim 1, *wherein*
- the different refractive indices are effected by different material composition and/or different doping levels and/or different dimensions of the superlattice layers.

5. The laser according to claim 4, *wherein*
- the different refractive indices are effected by different thicknesses of the superlattice layers.

6. The laser according to claim 4, *wherein*
- the at least two superlattice layers have essentially the same thickness.

7. The laser according to claim 4, *wherein*
- at least two superlattice layers of the same refractive index have essentially the same thickness.

8. The laser according to claim 4, *wherein*
- the thickness of a superlattice layer is essentially uniform.

9. The laser according to claim 1, *wherein*
- a plurality of superlattice layers with one of the refractive indices is provided and
- said superlattice layers vary in their thicknesses.

10. The laser according to claim 9, *wherein*
- the superlattice layers vary in their thicknesses, vertically decreasing from a maximum thickness close to the active region.

11. The laser according to claim 9, *wherein*
- the superlattice layers vary in their thicknesses, vertically increasing from a minimum thickness close to the active region.

12. The laser according to claim 9, *wherein*
- the superlattice layers vary vertically in their thicknesses, with a minimum thickness close to the active region, followed by a maximum thickness located centrally, and a minimum thickness located away from said active region.

13. The laser according to claim 9, *wherein*

- the superlattice layers vary vertically in their thicknesses, with a maximum thickness close the active region, followed by a minimum thickness located centrally, and a maximum thickness located away from said active region.

14. The laser according to claim 1, *wherein*

- an *InP*-based compound or *InP* is used for at least one of the superlattice layers.

15. The laser according to claim 1, *wherein*

- at least two superlattice layers exhibit approximately the same doping level, preferably *n*-doping level.

16. The laser according to claim 1, *wherein*

- at least two superlattice layers exhibit different doping levels, preferably *n*-doping levels, but the dimensions and/or materials of said two superlattice layers are approximately the same.

17. The laser according to claim 1, *wherein*

- at least one superlattice layer exhibits a varying doping level, preferably *n*-doping levels, namely a high doping level at positions having a high intensity of higher order modes of said laser and having a low overlap of the higher order modes with the zero order mode.

18. The laser according to claim 1, *wherein*

- dimensions and/or materials of the two superlattice layers are approximately the same.

19. The laser according to claim 1, *wherein*

- for a laser having a wavelength of about 1400nm to 1550nm, the superlattice layer is chosen
- from *InGaAsP* quaternaries having an emission wavelength between 940nm and 1300nm and
- being *n*-type doped between about $1x10^{17}$ cm^{-3} and $5x10^{18}$ cm^{-3}.

20. The laser according to claim 1, *wherein*

- for a laser having a wavelength of about 1200nm to 1300nm, the superlattice layer is chosen
- from *InGaAsP* quaternaries having an emission wavelength between 940nmm and 1100nm and
- being *n*-type doped between about $1x10^{17}$ cm^{-3} and $5x10^{18}$ cm^{-3}.

21. The laser according to claim 1, *wherein*

- one of the superlattice layers exhibits a refractive index of at least approximately the same magnitude as one of the cladding layers.

22. The laser according to claim 1, *wherein*

- one of the superlattice layers exhibits lattice parameters at least approximately equal to the lattice parameter of an adjacent cladding layer.

23. The laser according to claim 1, *wherein*

- the superlattice layer adjacent the active region exhibits the lower of the at least two refractive indices.

24. The laser according to claim 1, *wherein*

- the superlattice layer adjacent the active region exhibits a refractive index of the same magnitude as one of the cladding layers.

25. The laser according to claim 1, *wherein*
- one of the superlattice layers consists of the same material as one of the cladding layers, said material preferably being *InP*.

26. The laser according to claim 1, *wherein*
- the *n*-doping level of the superlattice layer is at least approximately equal to the *n*-doping level of an adjacent cladding layer.

27. The laser according to claim 1, *wherein*
- the large optical superlattice structure comprises between 4 and 20 superlattice layers with at least two different refractive indices.

28. The laser according to claim 1, *wherein*
- the total thickness of the optical superlattice structure is between 1000nm and 7000nm for a laser emitting at a wavelength between about 1400nm and 1550nm.